

CHUKA



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**EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF
SCIENCE IN COMPUTER SCIENCE AND BACHELOR OF EDUCATION
(ARTS AND SCIENCE) MATHEMATICS AND COMPUTER STUDIES**

COSC 325: DATA STRUCTURES AND ALGORITHMS

ACSC 225: DATA STRUCTURES AND ALGORITHMS

STREAMS:

TIME: 2 HOURS

DAY/DATE: WEDNESDAY 19/4/2023

11.30 A.M. – 1.30 P.M.

INSTRUCTIONS

****Attempt question ONE (Section A) and any other TWO from Section B**

****Marks are awarded for clear and concise answers**

SECTION A-Compulsory

Question ONE [30 Marks]

a) Briefly describe the following concepts as used with Data structures and Algorithms

i. Data Structure [2 marks]

ii. Algorithm Complexity [2 marks]

iii. Abstract data type [2 marks]

b) Give **THREE** operations that can be performed on an array [3 Marks]

c) Describe **FOUR** desirable features of an algorithm [4 Marks]

d) While giving relevant examples, differentiate between:

i. Array and Linked list [4 Marks]

ii. Pop and Push operations in a stack [4 Marks]

e) A binary tree is a set of data nodes connected via pointers. Using C++, define a class treenode with one integer data node and two pointers namely left and right [3 marks]

f) Give C++ program statement which would be used for each of the following:

i. Declare a pointer to an integer value [2 mark]

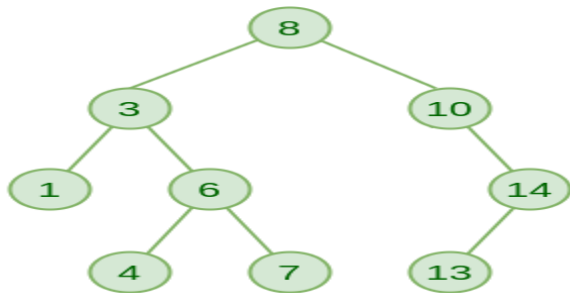
ii. Use the pointer to allocate memory [2 mark]

iii. Store a value using the pointer [2 mark]

SECTION B- Answer any TWO questions

Question TWO [20 Marks]

Study the binary search tree shown below and then use it to answer questions that follow:



a) Identify the terminal nodes of this tree [4 Marks]

b) Write the order of the nodes when visited in:

i. post-order traversal [5 Marks]

ii. Pre-order traversal [5 Marks]

c) Explain how you will search for value 7 from the tree [6 Marks]

Question THREE [20 Marks]

a) Given the following set of data: **44, 47, 36, 27, 98**. Illustrate how you would sort the data using the following techniques

(i) Selection Sort [5 marks]

(ii) Quick Sort [5 Marks]

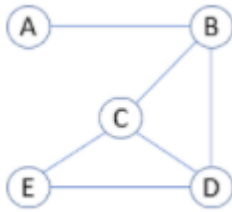
b) Using the following data: **59, 73, 26, 45, 63**, perform the following tasks

(i) Construct hash table using the hash function **Data mod 9** [5 Marks]

(ii) Construct a heap tree [5 Marks]

Question FOUR [20 Marks]

Study the graph shown below and then use it to answer questions that follow:



a) Construct adjacency matrix for the graph [5 Marks]

b) Taking **A** as the start vertex, show the order of traversal using:

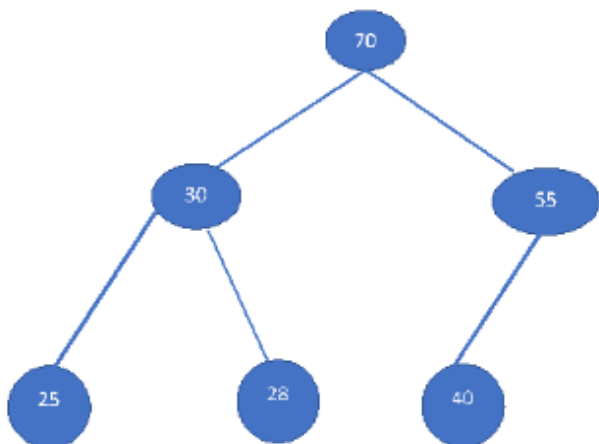
i. Depth first traversal [5 Marks]

ii. Breadth first traversal [5 Marks]

c) Construct adjacency list for the graph [5 Marks]

Question FIVE [20 Marks]

(a) Demonstrate how you would sort the data in the heap tree shown below [6 Marks]



(b) Using an appropriate example to illustrate, describe the difference between single-linked list, double-linked list and circular list. **[6 marks]**

(c) State and briefly describe the two main operations on a queue data structure. **[4 marks]**

(d) Explain how a stack can be implemented using linked list **[4 Marks]**

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